FIG. 1A

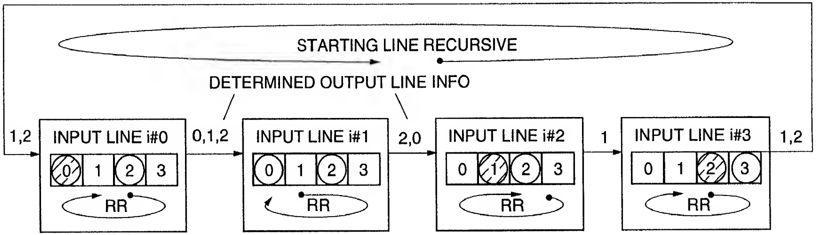


FIG. 1B

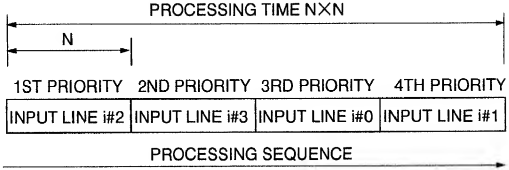


FIG. 1C

1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
INPUT LINE i#3	INPUT LINE i#0	INPUT LINE i#1	INPUT LINE i#2

FIG. 2A

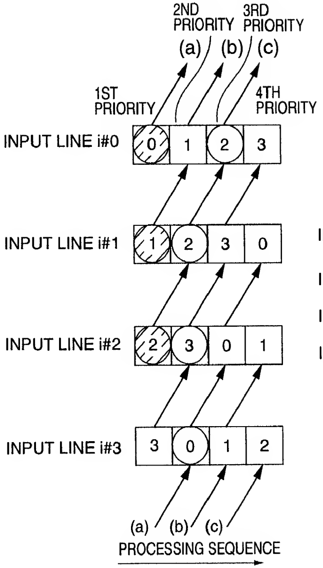


FIG. 2B

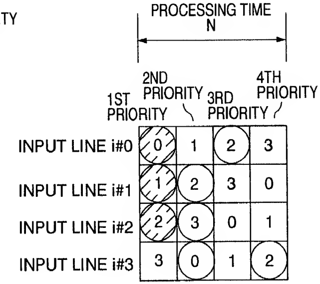


FIG. 2C

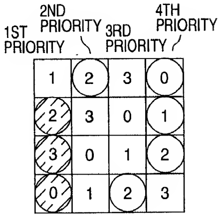


FIG. 3

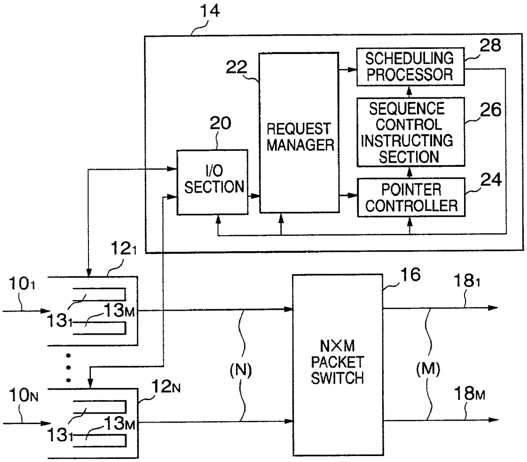

14
22
SCHEDULING PROCESSOR
28
REQUEST MANAGER
SEQUENCE CONTROL INSTRUCTING SECTION
26
20
I/O SECTION
POINTER CONTROLLER
24
12₁
10₁
13₁
13M
16
18₁
N×M PACKET SWITCH
(N)
(M)
10N
12N
13₁
13M
18M

FIG. 4

	1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
INPUT LINE i#0	0	1	2	3
INPUT LINE i#1	1	2	3	0
INPUT LINE i#2	2	3	0	1
INPUT LINE i#3	3	0	1	2

PATTERN P1

1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
1	2	3	0
2	3	0	1
3	0	1	2
0	1	2	3

PATTERN P2

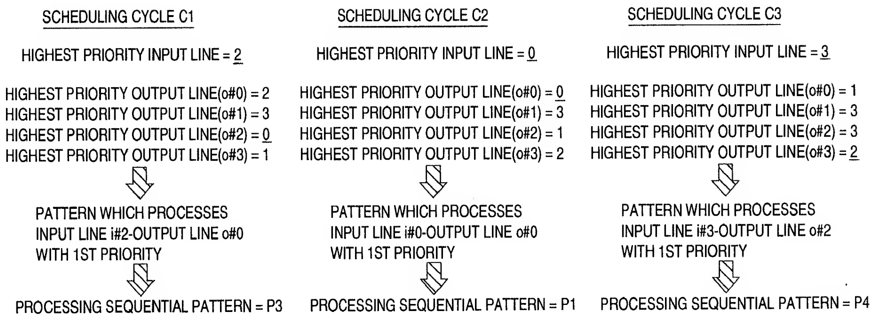
1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
2	3	0	1
3	0	1	2
0	1	2	3
1	2	3	0

PATTERN P3

1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
3	0	1	2
0	1	2	3
1	2	3	0
2	3	0	1

PATTERN P4

FIG. 5



SCHEDULING CYCLE C1

HIGHEST PRIORITY INPUT LINE = 2

HIGHEST PRIORITY OUTPUT LINE(o#0) = 2
HIGHEST PRIORITY OUTPUT LINE(o#1) = 3
HIGHEST PRIORITY OUTPUT LINE(o#2) = 0
HIGHEST PRIORITY OUTPUT LINE(o#3) = 1

PATTERN WHICH PROCESSES
INPUT LINE i#2-OUTPUT LINE o#0
WITH 1ST PRIORITY

PROCESSING SEQUENTIAL PATTERN = P3

SCHEDULING CYCLE C2

HIGHEST PRIORITY INPUT LINE = 0

HIGHEST PRIORITY OUTPUT LINE(o#0) = 0
HIGHEST PRIORITY OUTPUT LINE(o#1) = 3
HIGHEST PRIORITY OUTPUT LINE(o#2) = 1
HIGHEST PRIORITY OUTPUT LINE(o#3) = 2

PATTERN WHICH PROCESSES
INPUT LINE i#0-OUTPUT LINE o#0
WITH 1ST PRIORITY

PROCESSING SEQUENTIAL PATTERN = P1

SCHEDULING CYCLE C3

HIGHEST PRIORITY INPUT LINE = 3

HIGHEST PRIORITY OUTPUT LINE(o#0) = 1
HIGHEST PRIORITY OUTPUT LINE(o#1) = 3
HIGHEST PRIORITY OUTPUT LINE(o#2) = 3
HIGHEST PRIORITY OUTPUT LINE(o#3) = 2

PATTERN WHICH PROCESSES
INPUT LINE i#3-OUTPUT LINE o#2
WITH 1ST PRIORITY

PROCESSING SEQUENTIAL PATTERN = P4

FIG. 6

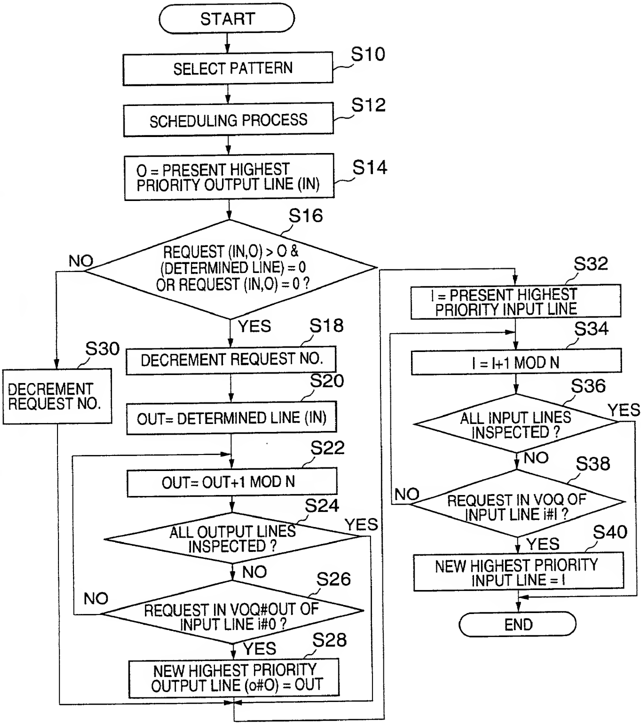

START
SELECT PATTERN
S10
SCHEDULING PROCESS
S12
O = PRESENT HIGHEST PRIORITY OUTPUT LINE (IN)
S14
S16
REQUEST (IN,O) > O & (DETERMINED LINE) = 0 OR REQUEST (IN,O) = 0 ?
NO
YES
S18
DECREMENT REQUEST NO.
S30
DECREMENT REQUEST NO.
S20
OUT= DETERMINED LINE (IN)
S22
OUT= OUT+1 MOD N
S24
ALL OUTPUT LINES INSPECTED ?
YES
NO
S26
REQUEST IN VOQ#OUT OF INPUT LINE i#0 ?
NO
YES
S28
NEW HIGHEST PRIORITY OUTPUT LINE (o#O) = OUT
S32
I = PRESENT HIGHEST PRIORITY INPUT LINE
S34
I = I+1 MOD N
S36
ALL INPUT LINES INSPECTED ?
YES
NO
S38
REQUEST IN VOQ OF INPUT LINE i#I ?
NO
YES
S40
NEW HIGHEST PRIORITY INPUT LINE = I
END

FIG. 7

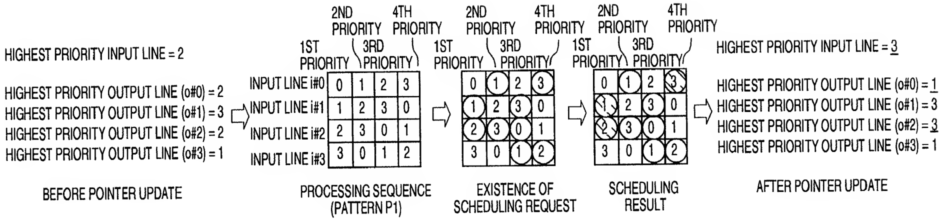

HIGHEST PRIORITY INPUT LINE = 2
HIGHEST PRIORITY OUTPUT LINE (o#0) = 2
HIGHEST PRIORITY OUTPUT LINE (o#1) = 3
HIGHEST PRIORITY OUTPUT LINE (o#2) = 2
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
INPUT LINE i#0
INPUT LINE i#1
INPUT LINE i#2
INPUT LINE i#3
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2
PROCESSING SEQUENCE (PATTERN P1)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY INPUT LINE = 3
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 3
HIGHEST PRIORITY OUTPUT LINE (o#2) = 3
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
AFTER POINTER UPDATE

FIG. 8

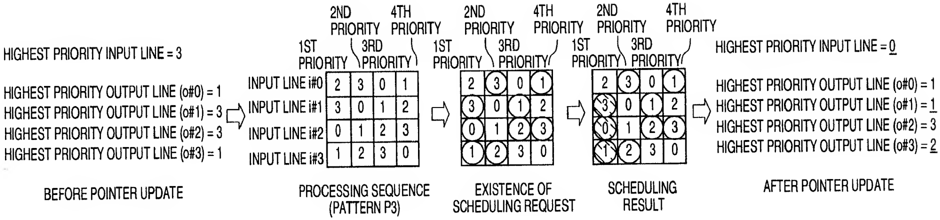

HIGHEST PRIORITY INPUT LINE = 3
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 3
HIGHEST PRIORITY OUTPUT LINE (o#2) = 3
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
INPUT LINE i#0
INPUT LINE i#1
INPUT LINE i#2
INPUT LINE i#3
2 3 0 1
3 0 1 2
0 1 2 3
1 2 3 0
PROCESSING SEQUENCE (PATTERN P3)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY INPUT LINE = 0
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 1
HIGHEST PRIORITY OUTPUT LINE (o#2) = 3
HIGHEST PRIORITY OUTPUT LINE (o#3) = 2
AFTER POINTER UPDATE

FIG. 9

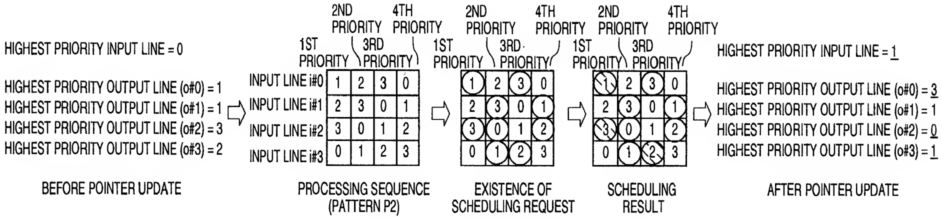

HIGHEST PRIORITY INPUT LINE = 0
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 1
HIGHEST PRIORITY OUTPUT LINE (o#2) = 3
HIGHEST PRIORITY OUTPUT LINE (o#3) = 2
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
INPUT LINE i#0
INPUT LINE i#1
INPUT LINE i#2
INPUT LINE i#3
1 2 3 0
2 3 0 1
3 0 1 2
0 1 2 3
PROCESSING SEQUENCE (PATTERN P2)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY INPUT LINE = 1
HIGHEST PRIORITY OUTPUT LINE (o#0) = 3
HIGHEST PRIORITY OUTPUT LINE (o#1) = 1
HIGHEST PRIORITY OUTPUT LINE (o#2) = 0
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
AFTER POINTER UPDATE

FIG. 10

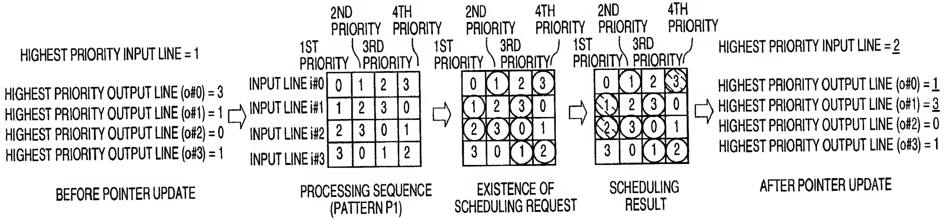

HIGHEST PRIORITY INPUT LINE = 1
HIGHEST PRIORITY OUTPUT LINE (o#0) = 3
HIGHEST PRIORITY OUTPUT LINE (o#1) = 1
HIGHEST PRIORITY OUTPUT LINE (o#2) = 0
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
INPUT LINE i#0
INPUT LINE i#1
INPUT LINE i#2
INPUT LINE i#3
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2
PROCESSING SEQUENCE (PATTERN P1)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY INPUT LINE = 2
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 3
HIGHEST PRIORITY OUTPUT LINE (o#2) = 0
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
AFTER POINTER UPDATE

FIG. 11

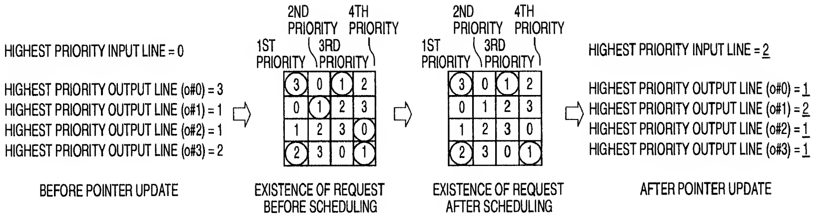

HIGHEST PRIORITY INPUT LINE = 0
HIGHEST PRIORITY OUTPUT LINE (o#0) = 3
HIGHEST PRIORITY OUTPUT LINE (o#1) = 1
HIGHEST PRIORITY OUTPUT LINE (o#2) = 1
HIGHEST PRIORITY OUTPUT LINE (o#3) = 2
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
3 0 1 2
0 1 2 3
1 2 3 0
2 3 0 1
EXISTENCE OF REQUEST BEFORE SCHEDULING
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
3 0 1 2
0 1 2 3
1 2 3 0
2 3 0 1
EXISTENCE OF REQUEST AFTER SCHEDULING
HIGHEST PRIORITY INPUT LINE = 2
HIGHEST PRIORITY OUTPUT LINE (o#0) = 1
HIGHEST PRIORITY OUTPUT LINE (o#1) = 2
HIGHEST PRIORITY OUTPUT LINE (o#2) = 1
HIGHEST PRIORITY OUTPUT LINE (o#3) = 1
AFTER POINTER UPDATE

FIG. 12

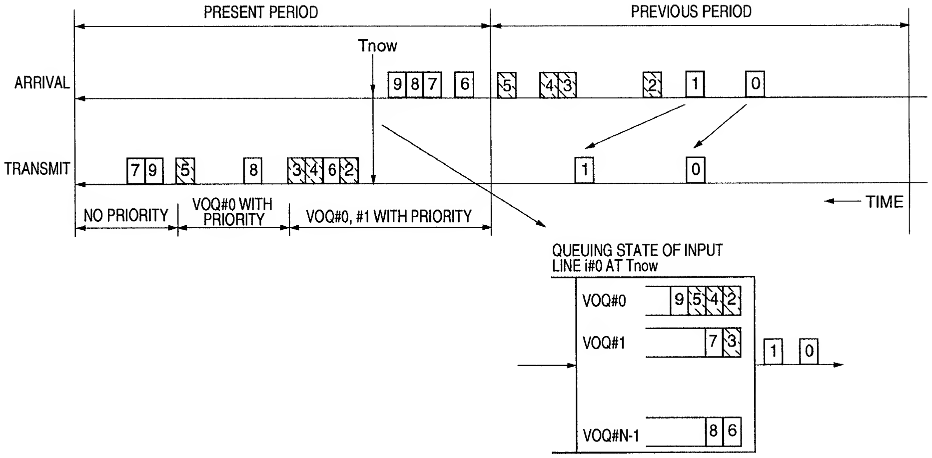
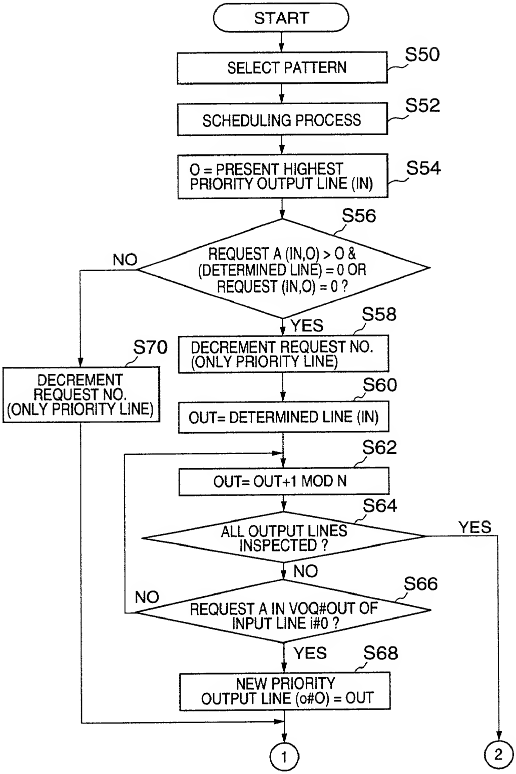

PRESENT PERIOD
PREVIOUS PERIOD
Tnow
ARRIVAL
9
8
7
6
5
4
3
2
1
0
TRANSMIT
7
9
5
8
3
4
6
2
1
0
TIME
NO PRIORITY
VOQ#0 WITH PRIORITY
VOQ#0, #1 WITH PRIORITY
QUEUING STATE OF INPUT LINE i#0 AT Tnow
VOQ#0
9
5
4
2
VOQ#1
7
3
VOQ#N-1
8
6
1
0

FIG. 13



START
SELECT PATTERN
S50
SCHEDULING PROCESS
S52
O = PRESENT HIGHEST PRIORITY OUTPUT LINE (IN)
S54
S56
REQUEST A (IN,O) > 0 & (DETERMINED LINE) = 0 OR REQUEST (IN,O) = 0 ?
NO
YES
S58
DECREMENT REQUEST NO. (ONLY PRIORITY LINE)
S70
DECREMENT REQUEST NO. (ONLY PRIORITY LINE)
S60
OUT= DETERMINED LINE (IN)
S62
OUT= OUT+1 MOD N
S64
ALL OUTPUT LINES INSPECTED ?
YES
NO
S66
REQUEST A IN VOQ#OUT OF INPUT LINE i#0 ?
NO
YES
S68
NEW PRIORITY OUTPUT LINE (o#O) = OUT
1
2

FIG. 14

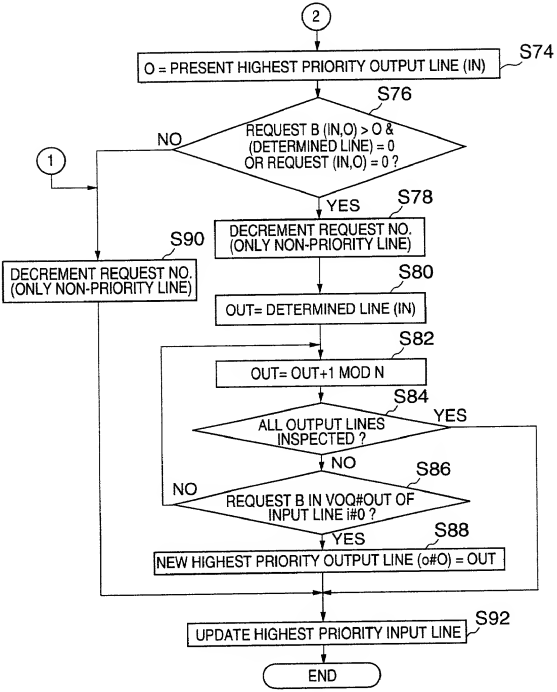

2
O = PRESENT HIGHEST PRIORITY OUTPUT LINE (IN)
S74
S76
REQUEST B (IN,O) > O &
(DETERMINED LINE) = 0
OR REQUEST (IN,O) = 0 ?
NO
1
YES
S78
DECREMENT REQUEST NO.
(ONLY NON-PRIORITY LINE)
S90
DECREMENT REQUEST NO.
(ONLY NON-PRIORITY LINE)
S80
OUT= DETERMINED LINE (IN)
S82
OUT= OUT+1 MOD N
S84
ALL OUTPUT LINES
INSPECTED ?
YES
NO
S86
NO
REQUEST B IN VOQ#OUT OF
INPUT LINE i#0 ?
YES
S88
NEW HIGHEST PRIORITY OUTPUT LINE (o#O) = OUT
S92
UPDATE HIGHEST PRIORITY INPUT LINE
END

FIG. 15

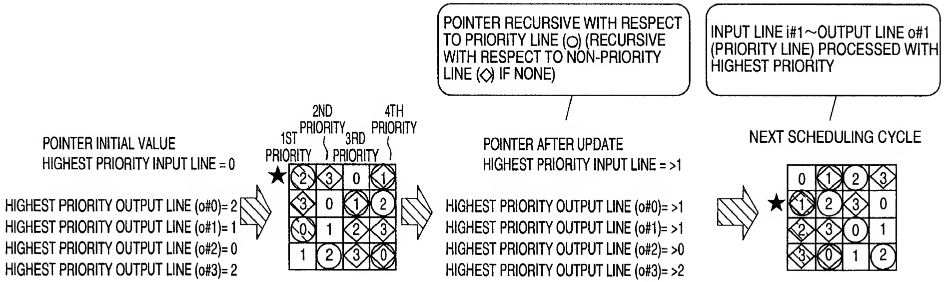

POINTER INITIAL VALUE
HIGHEST PRIORITY INPUT LINE = 0
HIGHEST PRIORITY OUTPUT LINE (o#0)= 2
HIGHEST PRIORITY OUTPUT LINE (o#1)= 1
HIGHEST PRIORITY OUTPUT LINE (o#2)= 0
HIGHEST PRIORITY OUTPUT LINE (o#3)= 2
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
2
3
0
1
3
0
1
2
0
1
2
3
1
2
3
0
POINTER RECURSIVE WITH RESPECT TO PRIORITY LINE (○) (RECURSIVE WITH RESPECT TO NON-PRIORITY LINE (◇) IF NONE)
POINTER AFTER UPDATE
HIGHEST PRIORITY INPUT LINE = >1
HIGHEST PRIORITY OUTPUT LINE (o#0)= >1
HIGHEST PRIORITY OUTPUT LINE (o#1)= >1
HIGHEST PRIORITY OUTPUT LINE (o#2)= >0
HIGHEST PRIORITY OUTPUT LINE (o#3)= >2
INPUT LINE i#1~OUTPUT LINE o#1 (PRIORITY LINE) PROCESSED WITH HIGHEST PRIORITY
NEXT SCHEDULING CYCLE
0
1
2
3
1
2
3
0
2
3
0
1
3
0
1
2

FIG. 16

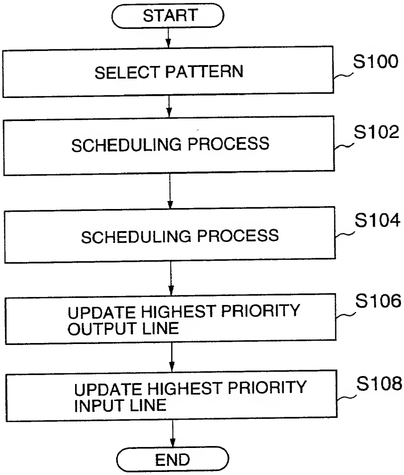

START
SELECT PATTERN
S100
SCHEDULING PROCESS
S102
SCHEDULING PROCESS
S104
UPDATE HIGHEST PRIORITY OUTPUT LINE
S106
UPDATE HIGHEST PRIORITY INPUT LINE
S108
END

FIG. 17

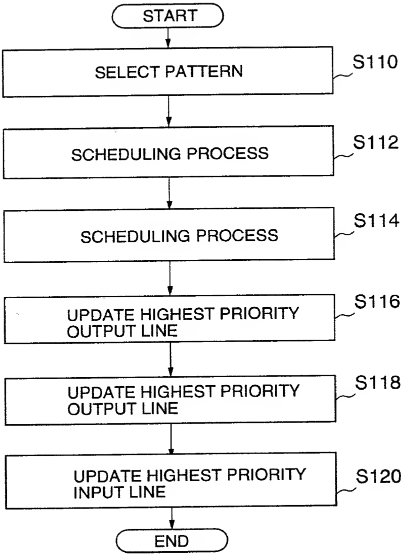

START
SELECT PATTERN
S110
SCHEDULING PROCESS
S112
SCHEDULING PROCESS
S114
UPDATE HIGHEST PRIORITY OUTPUT LINE
S116
UPDATE HIGHEST PRIORITY OUTPUT LINE
S118
UPDATE HIGHEST PRIORITY INPUT LINE
S120
END

FIG. 18

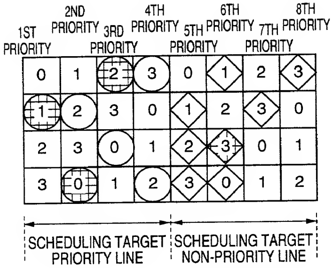

1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
5TH PRIORITY
6TH PRIORITY
7TH PRIORITY
8TH PRIORITY
0 1 2 3 0 1 2 3
1 2 3 0 1 2 3 0
2 3 0 1 2 3 0 1
3 0 1 2 3 0 1 2
SCHEDULING TARGET PRIORITY LINE
SCHEDULING TARGET NON-PRIORITY LINE

FIG. 19

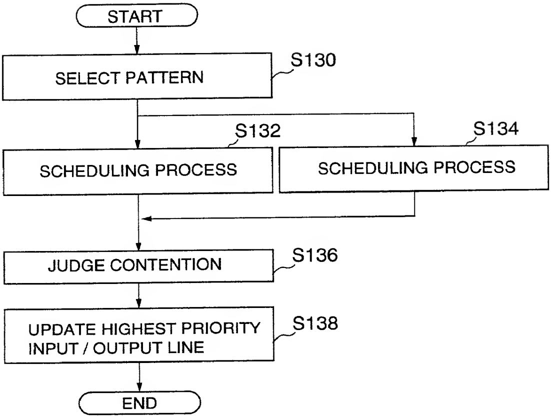

START
SELECT PATTERN
S130
S132
S134
SCHEDULING PROCESS
SCHEDULING PROCESS
JUDGE CONTENTION
S136
UPDATE HIGHEST PRIORITY INPUT / OUTPUT LINE
S138
END

FIG. 20

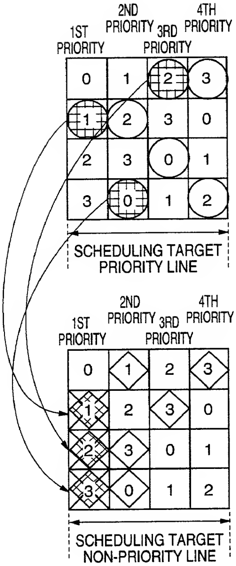

1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
0
1
2
3
1
2
3
0
2
3
0
1
3
0
1
2
SCHEDULING TARGET PRIORITY LINE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
0
1
2
3
1
2
3
0
2
3
0
1
3
0
1
2
SCHEDULING TARGET NON-PRIORITY LINE

FIG. 21

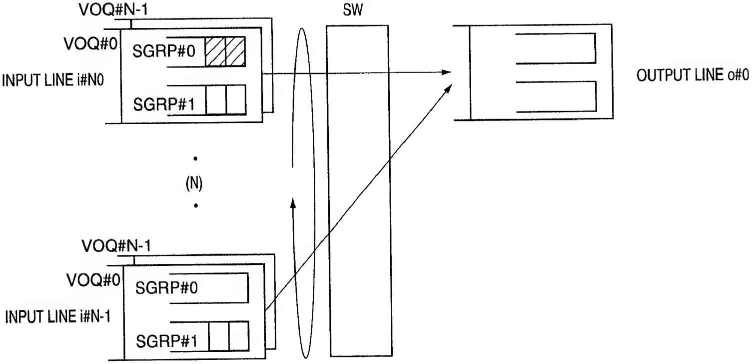

VOQ#N-1
VOQ#0
INPUT LINE i#N0
SGRP#0
SGRP#1
(N)
VOQ#N-1
VOQ#0
INPUT LINE i#N-1
SGRP#0
SGRP#1
SW
OUTPUT LINE o#0

FIG. 22

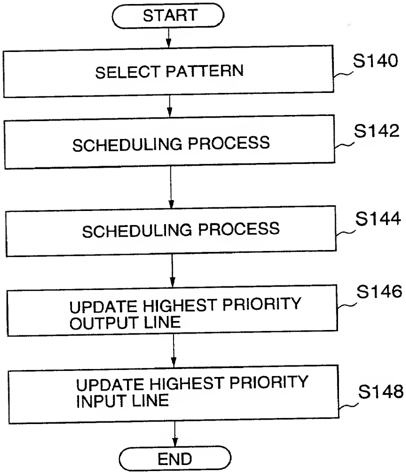

START
SELECT PATTERN
S140
SCHEDULING PROCESS
S142
SCHEDULING PROCESS
S144
UPDATE HIGHEST PRIORITY OUTPUT LINE
S146
UPDATE HIGHEST PRIORITY INPUT LINE
S148
END

FIG. 23

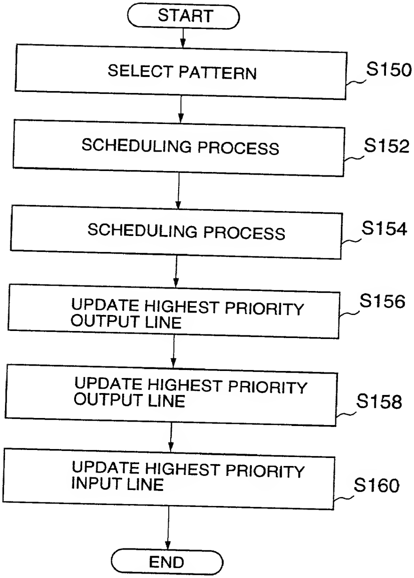

START
SELECT PATTERN
S150
SCHEDULING PROCESS
S152
SCHEDULING PROCESS
S154
UPDATE HIGHEST PRIORITY OUTPUT LINE
S156
UPDATE HIGHEST PRIORITY OUTPUT LINE
S158
UPDATE HIGHEST PRIORITY INPUT LINE
S160
END

FIG. 24

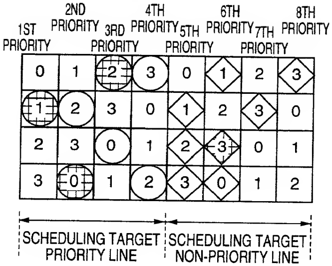

1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
5TH PRIORITY
6TH PRIORITY
7TH PRIORITY
8TH PRIORITY
0 1 2 3 0 1 2 3
1 2 3 0 1 2 3 0
2 3 0 1 2 3 0 1
3 0 1 2 3 0 1 2
SCHEDULING TARGET PRIORITY LINE
SCHEDULING TARGET NON-PRIORITY LINE

FIG. 25

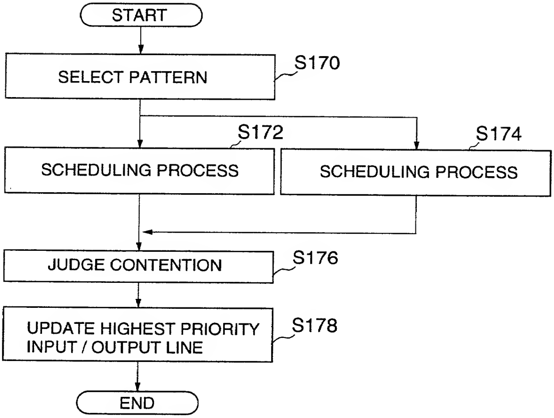

START
SELECT PATTERN
S170
S172
S174
SCHEDULING PROCESS
SCHEDULING PROCESS
JUDGE CONTENTION
S176
UPDATE HIGHEST PRIORITY INPUT / OUTPUT LINE
S178
END

FIG. 26

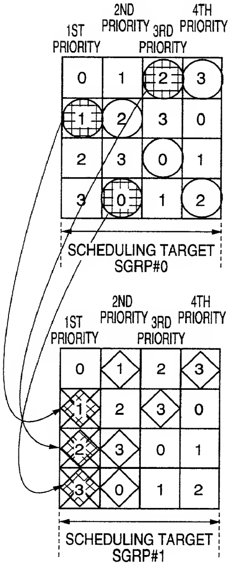

1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2
SCHEDULING TARGET SGRP#0
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2
SCHEDULING TARGET SGRP#1

FIG. 27

	1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
OUTPUT LINE o#0	0	1	2	3
OUTPUT LINE o#1	1	2	3	0
OUTPUT LINE o#2	2	3	0	1
OUTPUT LINE o#3	3	0	1	2

PATTERN P1

	1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
OUTPUT LINE o#0	1	2	3	0
OUTPUT LINE o#1	2	3	0	1
OUTPUT LINE o#2	3	0	1	2
OUTPUT LINE o#3	0	1	2	3

PATTERN P2

	1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
OUTPUT LINE o#0	2	3	0	1
OUTPUT LINE o#1	3	0	1	2
OUTPUT LINE o#2	0	1	2	3
OUTPUT LINE o#3	1	2	3	0

PATTERN P3

	1ST PRIORITY	2ND PRIORITY	3RD PRIORITY	4TH PRIORITY
OUTPUT LINE o#0	3	0	1	2
OUTPUT LINE o#1	0	1	2	3
OUTPUT LINE o#2	1	2	3	0
OUTPUT LINE o#3	2	3	0	1

PATTERN P4

FIG. 28

SCHEDULING CYCLE C1

HIGHEST PRIORITY OUTPUT LINE = 2

HIGHEST PRIORITY INPUT LINE(i#0) = 2
HIGHEST PRIORITY INPUT LINE(i#1) = 3
HIGHEST PRIORITY INPUT LINE(i#2) = 0
HIGHEST PRIORITY INPUT LINE(i#3) = 1

⇩

PATTERN WHICH PROCESSES
OUTPUT LINE o#2-INPUT LINE i#0
WITH 1ST PRIORITY

⇩

PROCESSING SEQUENTIAL PATTERN = P3

SCHEDULING CYCLE C2

HIGHEST PRIORITY OUTPUT LINE = 0

HIGHEST PRIORITY INPUT LINE(i#0) = 0
HIGHEST PRIORITY INPUT LINE(i#1) = 3
HIGHEST PRIORITY INPUT LINE(i#2) = 1
HIGHEST PRIORITY INPUT LINE(i#3) = 2

⇩

PATTERN WHICH PROCESSES
OUTPUT LINE o#0-INPUT LINE i#0
WITH 1ST PRIORITY

⇩

PROCESSING SEQUENTIAL PATTERN = P1

SCHEDULING CYCLE C3

HIGHEST PRIORITY OUTPUT LINE = 3

HIGHEST PRIORITY INPUT LINE(i#0) = 1
HIGHEST PRIORITY INPUT LINE(i#1) = 3
HIGHEST PRIORITY INPUT LINE(i#2) = 3
HIGHEST PRIORITY INPUT LINE(i#3) = 2

⇩

PATTERN WHICH PROCESSES
OUTPUT LINE o#3-INPUT LINE i#2
WITH 1ST PRIORITY

⇩

PROCESSING SEQUENTIAL PATTERN = P4

FIG. 29

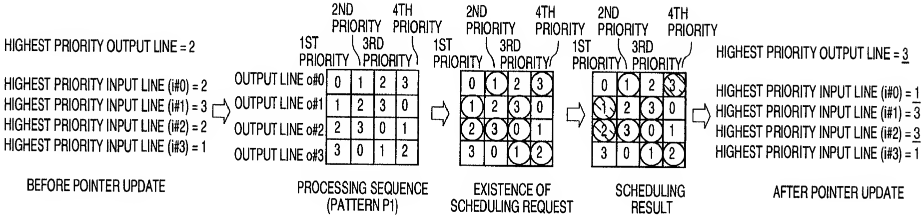

HIGHEST PRIORITY OUTPUT LINE = 2
HIGHEST PRIORITY INPUT LINE (i#0) = 2
HIGHEST PRIORITY INPUT LINE (i#1) = 3
HIGHEST PRIORITY INPUT LINE (i#2) = 2
HIGHEST PRIORITY INPUT LINE (i#3) = 1
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
OUTPUT LINE o#0
OUTPUT LINE o#1
OUTPUT LINE o#2
OUTPUT LINE o#3
0 1 2 3
1 2 3 0
2 3 0 1
3 0 1 2
PROCESSING SEQUENCE (PATTERN P1)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY OUTPUT LINE = 3
HIGHEST PRIORITY INPUT LINE (i#0) = 1
HIGHEST PRIORITY INPUT LINE (i#1) = 3
HIGHEST PRIORITY INPUT LINE (i#2) = 3
HIGHEST PRIORITY INPUT LINE (i#3) = 1
AFTER POINTER UPDATE

FIG. 30

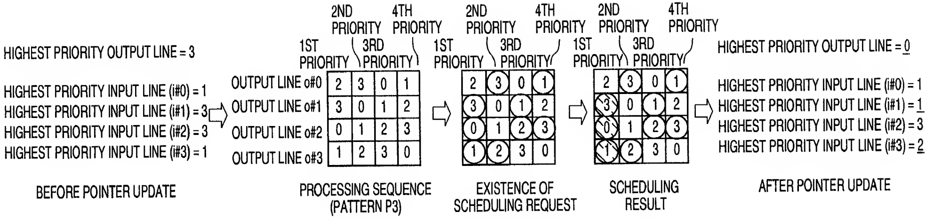

HIGHEST PRIORITY OUTPUT LINE = 3
HIGHEST PRIORITY INPUT LINE (i#0) = 1
HIGHEST PRIORITY INPUT LINE (i#1) = 3
HIGHEST PRIORITY INPUT LINE (i#2) = 3
HIGHEST PRIORITY INPUT LINE (i#3) = 1
BEFORE POINTER UPDATE
1ST PRIORITY
2ND PRIORITY
3RD PRIORITY
4TH PRIORITY
OUTPUT LINE o#0
OUTPUT LINE o#1
OUTPUT LINE o#2
OUTPUT LINE o#3
2
3
0
1
3
0
1
2
0
1
2
3
1
2
3
0
PROCESSING SEQUENCE (PATTERN P3)
EXISTENCE OF SCHEDULING REQUEST
SCHEDULING RESULT
HIGHEST PRIORITY OUTPUT LINE = 0
HIGHEST PRIORITY INPUT LINE (i#0) = 1
HIGHEST PRIORITY INPUT LINE (i#1) = 1
HIGHEST PRIORITY INPUT LINE (i#2) = 3
HIGHEST PRIORITY INPUT LINE (i#3) = 2
AFTER POINTER UPDATE

FIG. 31

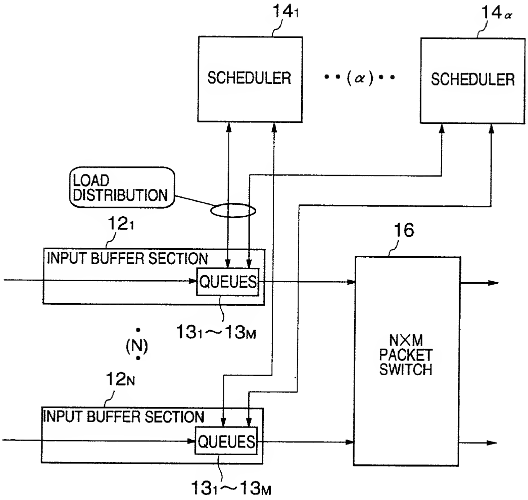
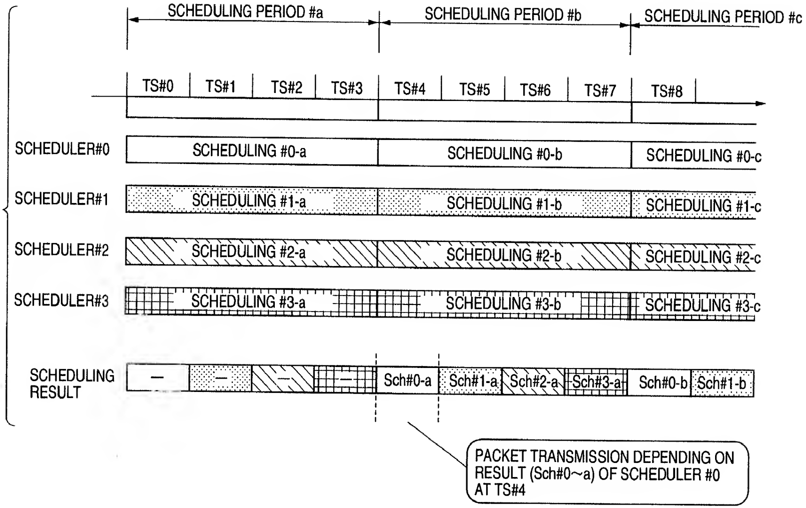

14₁
14α
SCHEDULER
• • (α) • •
SCHEDULER
LOAD DISTRIBUTION
12₁
INPUT BUFFER SECTION
QUEUES
13₁～13M
16
N×M PACKET SWITCH
(N)
12N
INPUT BUFFER SECTION
QUEUES
13₁～13M

FIG. 32


SCHEDULING PERIOD #a
SCHEDULING PERIOD #b
SCHEDULING PERIOD #c
TS#0
TS#1
TS#2
TS#3
TS#4
TS#5
TS#6
TS#7
TS#8
SCHEDULER#0
SCHEDULING #0-a
SCHEDULING #0-b
SCHEDULING #0-c
SCHEDULER#1
SCHEDULING #1-a
SCHEDULING #1-b
SCHEDULING #1-c
SCHEDULER#2
SCHEDULING #2-a
SCHEDULING #2-b
SCHEDULING #2-c
SCHEDULER#3
SCHEDULING #3-a
SCHEDULING #3-b
SCHEDULING #3-c
SCHEDULING RESULT
—
—
—
—
Sch#0-a
Sch#1-a
Sch#2-a
Sch#3-a
Sch#0-b
Sch#1-b
PACKET TRANSMISSION DEPENDING ON RESULT (Sch#0~a) OF SCHEDULER #0 AT TS#4